APPENDIX C

TEXAS DEPARTMENT OF WATER RESOURCES
1700 N. Cong[illegible]ss Avenue
Austin, Texas

December 20, 1979

Ms. Nevenna Travis
Texas Systems of Natural Laboratories, Inc.
610 Brazos Street
Austin, Texas 78701

Dear Ms. Travis:

On December 19, you inquired about the Department's computer models of the bays and estuaries. I understand you are interested in whether or not these computer models can be used to predict movement of oil within the Texas estuarine system. We feel that with additional information, which would have to be obtained at the seaward location of the Gulf and estuarine exchange points, the computer model could be used to predict the movement of oil and "tar balls" within the estuaries that enter through these inlets. The data that are needed are samples of the concentrations of materials passing from the Gulf through tidal action into the estuary.

The Department's two-dimensional tidal hydrodynamic model computes the tidally generated flows and velocities in the two horizontal coordinate directions given certain simplifying assumptions. The most important assumption is that the bay is well-mixed in the vertical, i.e., the velocity and density are constant with depth. In addition, in order to solve the differential equations which describe the tidal motion in a well-mixed estuary, the estuary is represented by a matrix of one-nautical mile square computational cells. The equations are solved for each of these computational cells, thus, the computed velocities in each of the two coordinate directions represent an average velocity across a one-nautical mile front.

To simulate real-time variations in tidal velocities, the tidal hydrodynamic model can be modified to output "instantaneous" velocities at time intervals as short as two minutes, subject to the availability of sufficient computer storage.

The operation of the tidal hydrodynamic model requires the specification of certain input conditions. These input conditions which must be known include the tidal conditions at all tidally influenced boundaries of the estuary, i.e., the Gulf exchange pass and all side bays, all freshwater inflows, wind speed and direction, evaporation, and rainfall. Thus, the long-term simulation of tidal velocities requires the specification of the Gulf tidal conditions throughout the simulation period or the assumption that the Gulf tidal conditions remain constant from one tidal cycle to the next.

The use of these computed tidal velocities to predict the dispersion of a pollutant throughout the estuary requires, in addition to the assumption of a vertically well-mixed estuary, that the pollutant be a "conservative" constituent. This means that there is no significant, short-term (i.e., daily) degradation or generation of the pollutant within the estuary by physical, chemical, or biological reactions.

Subject to these assumptions, the instantaneous velocities can be used to predict the movement of the pollutant within the estuary over a short time period such as a tidal cycle, or the tidal velocities, averaged over a tidal cycle, can be used in conjunction with the conservative mass transport model to predict the "gross" movement of the pollutant over long-time periods, assuming a continuous repetition of tidal conditions from one tidal cycle to the next.

The models described above have been developed for the purpose of analyzing the freshwater inflow needs of the bays and estuaries of Texas. Each model has been computed and calibrated using "field" data collected in each respective estuary. In our judgment these individually constructed computer models are the best available tool with which to make estimates of the transport of suspended material that might enter the bays. However, I reiterate, it would be necessary to sample at the tidal inlets, in order to collect data about the concentration of materials in suspension.

We will be happy to provide descriptive detail of the models and to provide further explanations.

Sincerely,

Herbert W. Grubb

Herbert W. Grubb
Director, Planning and
Development Division

Input-Output Branch
List of Reports

"Main Models"

TITLE	AUTHOR(s)	NUMBER
The Input-Output Model for the State of Texas	Grubb Lesso	5102-R25-0973-RAN
A Structural Analysis of the Texas Economy Using Input-Output Models	Grubb	7400-R14-0673
Using Input-Output Models for Economic Analyses of Energy Consumption in Texas	Grubb	0025-030-1174-NR
Selected National Economic and Energy Policy Impacts on the Texas Economy: An Input-Output Simulation Model Analysis	Grubb Holloway Grossman	0025-051-0675-NR
An Economic Simulation Model for Analysing Energy Policy Impacts in Texas	Holloway Grubb Grossman	0025-052-0775-NR
Water Resources Planning: Analytic Techniques and Policy Implications from a State Viewpoint	Grubb Holloway Williams	0025-054-0875

TWODB SOFTWARE INVENTORY PROGRAMS RECEIVED
AS OF OCTOBER 3, 1979

PEP	Parameter Estimation Program	Quentin Martin
PIPEX-I	Pipeline Optimal Capacity Expansion Model	" "
CAPEX-I	Pump Station Capacity Expansion Model	" "
DEMAND-II	Irrigation, Industrial & Municipal Water Demand Model	" "
SIM-IV	Multibasin Simulation & Optimization Model	" "
DPSIM-I	Opt. Cap. Expan. Model for Surface Water Systems	" "
AL-IV	Water Supply Allocation Model	" "
SIMYLD-II	River Basin Simulation Model	" "
CANAL-I	Water Conveyance Canal Design Model	" "
ECOSYM	Economic Simulation Model	" "
QUAL-I	Stream Quality Model	Mike Sullivan
QUAL-II	Stream Quality Model	" "
LAKECO	Lake Ecological Model	" "
QNET-I	Multibasin Water Quality Simulation Model	" "
DOSAG-I	Stream Quality Routing Model	" "
DELTA	Delta, River Delta Hydroynamic and Water Quality Simulation Model	" "
FILLIN-I	Multi-Site Data Fill-In	Steve Densmore
SEQUEN-I	Sequence Analysis Program	" "
RESOP-II	Reservoir Operating & Quality Routing Pgm	Lew Browder
IMAGEW-I	Well Field Drawdown Model	Tommy Knowles
CARIZO	Carrizo Aquifer Digital Model	" "
GWSIM-II	Ground Water Simulation Program II	" "
GWSIM	Groundwater Simulation Program	" "
ESTECO	Estuarine Ecologic Model	Gordon Thorn
DEM	Dynamic Estuary Model	" "
HYD	Tidal Hydrodynamic Model	" "
RIVTID	River/Tidal Hydrodynamic Model	" "
SAL	Salinity Transport Model	" "
AUTO QD	Auto Qual Modeling System	Dale White
GBP	Galveston Bay Project Nitrogenous BOD Model	" "
GBP	" " " Hydraulic Model	" "
QUAL-IIQ	Qual-IIQ	" "
AUTOSS	Auto-Qual Modeling System	" "
GBP	Galveston Bay Salinity Model	" "
GBP	Galveston Bay Project BOD Model	" "
GBP	Galveston Bay Project DO Model	" "

WD0900	Flood Hydrograph Analysis	T. R. Evans
WD9000	BURDAT	" " "
WD1100	Water Surface Profiles	" " "
WD1200	Unsteady Flow Model (SOCH/GEDA)	" " "
WD1300	Reservoir Operating & Quality Routing	" " "
WD1400	Flood Flow Frequency Analysis	" " "
WD2000	Flood Hydrograph System	" " "
WD2900	Irrigation Water Requirements	" " "
WD4500	Hymo	" " "
WD5300	STORM	" " "
WD5900	River Tidal Hydrodynamics & Quality	" " "
WD6200	LOQUOT	" " "
WD7200	Inter-Industry Resource Model	" " "
WD8500	High Plains Input-Output Model	" " "
DW1600	Moving Average	" " "
PRCSYS	Pecos River Compact System	Larry Crow
WAPAM	Water Availability & Priority Allocation	" "

TWODB SOFTWARE INVENTORY PROGRAMS
continued

AL-IV	Water Supply Allocation Model	T. R. Evans
AQCHEM	Aquifer Chemical Quality	" " "
ASTEP	ASTEP	" " "
AUTO QD	AUTO - Qual Modeling System	" " "
AUTOSS	AUTO - QUAL Modeling System	" " "
BMD	BMDP Biomedical Computer Programs	" " "
CALFORM	Computer Mapping System	" " "
CAPEX-I	Pump Station Capacity Expansion Model	" " "
CARIZO	Carrizo Aquifer Digital Model	" " "
CHEMQ	Chemical Quality	" " "
CPS-1	Contour Plotting	" " "
DAM	DAM	" " "
DEM	Dynamic Estuary Model	" " "
DEMAND-II	Irrig., Ind. and Mun. Water Demand Model	" " "
DES	Dynamic Economic Simulation Model	" " "
DISSPLA	Computer Graphics	" " "
DMED	Streamflow/Precip Graphics Routine	" " "
DMS 1100	Data Base Management System	" " "
DOSAG-I	Stream Quality Routing Model	" " "
DPSIM-I	Opt. Cap. Expan. Model for Surf. Water Sys.	" " "
EOCSYM	Economic Simulation Model	" " "
ELLTAB	EBLTAB	" " "
ESTECO	Estuarine Ecologic Model	" " "
ESTPOL 1	ESTPOL - I	" " "
ESTPOL 2	ESTPOL - II	" " "
FASTEP	Step-Drawn Test Analysis by Computer	" " "
FILLIN-I	Multi-Site Data Fill-In	" " "
GBP	Galveston Bay Project BOD Model	" " "
GBP	Galveston Bay Project DO Model	" " "
GBP	Galveston Bay Project Hydraulic Model	" " "
GBP	Galveston Bay Project Nitrogenous BOD Model	" " "
GBP	Galveston Bay Salinity Model	" " "
GWSIM	Groundwater Simulation Program	" " "
HAREQ	Harrill's Equation	" " "
HCM	Hirsch Cloud Model	" " "
HYD	Tidal Hydrodynamic Model	" " "
IMAGEW-I	Well Field Drawdown Model	" " "
IMSL	International Mathemathical and Statistical Libraries	" " "
LAKECO	Lake Ecological Model	" " "
LARSYS	LARSYS	" " "
MATH/STAT	PACK MATH/STAT PACK	" " "
MOSS-IV	Monthly Streamflow Simulation	" " "
O'Connor	Program GALV Hydroscience Model for the Houston Ship Channel	" " "

PEP	Parameter Estimation Program	T. R. Evans
PIPEX-I	Pipeline Optimal Cap. Expansion Model	" " "
POLYVRT	POLYVRT	" " "
PRCSYS	Pecos River Compact System	" " "
QNET-I	Multibasin Water Quality Sim. Model	" " "
QUAL-I	Stream Quality Model	" " "
QUAL-II	Stream Quality Model	" " "
QUAL-IIQ	QUAL-IIQ	" " "
RESOP-I	Reservoir Operation & Quality Routing Program	" " "
RIVER	Program RIVER by Hydroscience, Inc.	" " "
RIVTID	River/Tidal Hydrodynamic Model	" " "
SAL	Salinity Transport Model	" " "
SEISMIC	Refraction Seismic Program	" " "
SEQUEN-I	Sequence Analysis Program	" " "
SIM-IV	Multibasin Sim. & Optimization Model	" " "
SIMYLD-II	River Basin Simulation Model	" " "
SPSS	Statistical Package	" " "
SYMAP	Computer Mapping System	" " "
SYMVU	3-D Plotting System	" " "
SYSTEM 2000	Data Base Management System	" " "
WAPAM	Water Availability & Priority Allocation Model	" " "
WQAL	Water Quality	" " "
WRECEV	WRECEV	" " "
ZOHDY-S	ZOHDY-SCLUMBERGER	" " "